Revised: July 24, 2017

EE 354 **Assigned: August 23, 2017**
Project 1 **Due: October 20, 2017**
Pong

Description
Pong was first manufactured by Atari in 1972 and is considered to be the first video game to become wildly popular. Pong was also available and very popular on the *Magnavox Odyssey* which was the first home console. *Pong* is modeled after table tennis and the rules of play are similar. In the console application a single player could play against the computer or two players could play against each other. Figure 1 shows a screen shot of a pong game in action. The net is represented by the dotted line down the middle of the screen. The score is given by the two numbers on either side of the net. Each player has a paddle represented by the rectangles on either side of the screen. The paddles can only move up and down. The ball is the square dot in the bottom right of the screen.

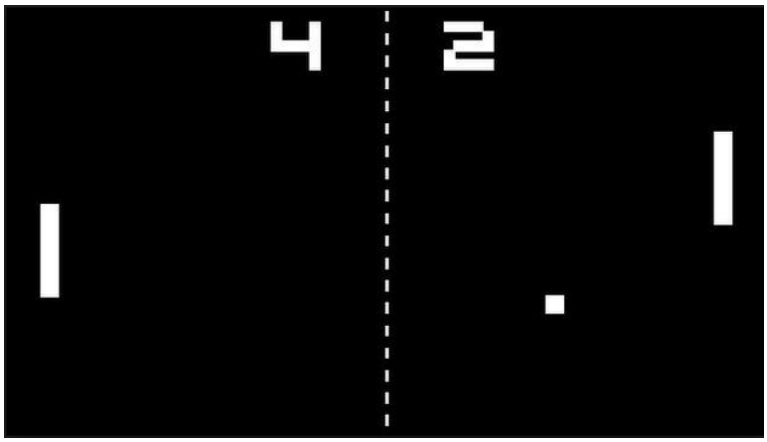

Figure 1
Screen shot of pong.

A player earns one point when her opponent fails to return the ball. The first player to get to eleven points wins. To return the ball a player must move her paddle vertically to intercept the ball's path. In many arcade games the paddle is divided into eight segments and the segment that hits the ball determines the angle of the ball's return. In some versions the ball could be made to follow a curved path, as in adding English, if it was hit by a moving paddle. Background music and the plink sound of the ball hitting the paddle is common.

Specifications
LEDs
We will use two arrays of LEDs where each array has 8 x 8 diodes arranged in a square. A typical 8 x8 array is available here:
http://www.tme.eu/en/details/kwm-20881cvb/led-displays-matrix/lucky-light/
or here:
https://www.adafruit.com/?q=8x8%20&

The KWM-20881CVB array is just 0.8 inches square and we will use this in class. If you prefer, AdaFruit has a larger array (1.2 inches square) that can also be used.

The physical arrangement of the LEDs and a circuit diagram for a single 8 x 8 array is shown in Figure 2.

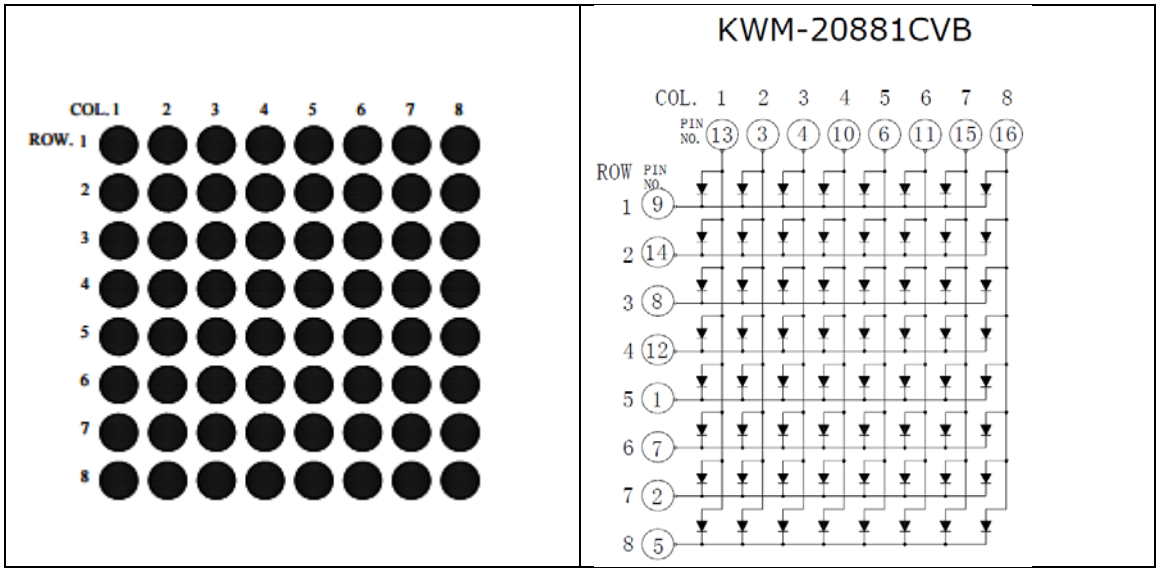

Figure 2
An array of 8 x 8 LEDs. Note that there are 64 diodes but only 16 pins where each pin is a common cathode or common anode for 8 LEDs. By making a cathode line low and an anode line high you can turn on any one LED. This is the pinout for the KWM-20881CVB array. The larger AdaFruit array has a different pinout.

Paddles

We will use potentiometers for the paddles. You should have two modes of play: one in which there is a single player and the computer is the second player and a second mode in which there are two human players. Each human player will have a potentiometer which can be read by the A/D converter to determine the position of the paddle. The paddle will be represented by three LEDs in a column and each paddle should have *at least* one LED on the screen at all times – the player should not be able to move the paddle entirely off screen.

Scoring

We will keep score in binary along the top row of LEDs which each player's score shown on the appropriate side of the screen. The winner should be indicated with sounds, lights, or in some other manner that makes it clear that the game is over.

The pong game which you build should meet the following specifications:

1. The game which you build must fit within a container that is no larger than 6" x 8" x 2". If you wish, you may place the paddle potentiometers on a cable or, they can be built into the playing board.
2. The game must be completely self-contained and battery operated.

3. The game must be sturdy enough to survive a four foot drop onto a concrete floor.
4. You must use the AT89C51CC03 processor to drive your game.
5. You must have an on/off switch and a reset switch.
6. Your container must be relatively water resistant. For testing purposes 8 ounces of water will be poured over each game while it is running. This water must not impede the game in any way.
7. Your container must be secure and should not rattle when shaken.
8. You must provide a mechanism for changing the batteries that does not require disassembly. Removing one or two screws is acceptable.
9. Your software must contain at least one subprogram in C and at least one subprogram in 8051 assembler.
10. Your project must consider the following factors in the design: safety, manufacturability, economic, environmental, and reliability.

Variations on the original game are encouraged.

Grading:

This project will be done individually and a single grade will be given for each project. A total of 100 points is available for the project and will be awarded on the following basis:

Points	Item
25 points	Does your project work and meet specifications
15 points	Creativity and novel added features
15 points	Finished product quality
15 points	Documentation of software
15 points	Documentation of hardware
15 points	Other documentation

The project report should consist of:

- A cover sheet with your name, the project number and title, and the date turned in.
- A list of novel features. Creativity may consist of novel hardware or software implemented features or a novel packaging technique.
- A list of those items you were able to demonstrate as working to the instructor.
- A discussion of how you considered safety, reliability, economic, manufacturability, and environmental factors.
- An estimate based on theoretical and empirical data as to the power requirements.
- Hardware documentation.
- Software documentation.

At a minimum your hardware documentation must consist of a system diagram, a complete circuit diagram (with pin numbers), and a mechanical sketch or photo of your project done to a level of detail such that another person in the class could build your project from your diagram. At a minimum your software documentation should consist of fully commented source code for all of the

modules in your program and a pseudocode design with enough detail that another person in the class could duplicate the function of your software.

The grade for this project will be based on what is complete and handed in as of ***11:00am on October 20, 2017. No late grades will be given.***